

METHYL CHLOROFORM

Methyl chloroform is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 71-55-6

CCl_3CH_3

Molecular Formula: $\text{C}_2\text{H}_3\text{Cl}_3$

Methyl chloroform is a nonflammable, colorless liquid with a chloroform-like odor. It is insoluble in water, and soluble in acetone, benzene, carbon tetrachloride, methanol, and ether (Sax, 1989).

Physical Properties of Methyl Chloroform

Synonyms: 1,1,1-trichloroethane; chloroethene; methyl trichloromethane

Molecular Weight:	133.42
Boiling Point:	74.1 °C
Melting Point:	-30.4 °C
Vapor Density:	4.63 (air = 1)
Density/Specific Gravity:	1.3376 at 20/4 °C (water = 1)
Vapor Pressure:	123.7 mm Hg at 25 °C
Log Octanol/Water Partition Coefficient:	2.49
Water Solubility:	1,495 mg/L at 25 °C
Conversion Factor:	1 ppm = 5.4 mg/m ³

(Howard, 1990; HSDB, 1991; Merck, 1983; Sax, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Methyl chloroform is widely used as an industrial solvent and degreaser, as a dry cleaning agent, as a component of aerosols formulations, and as a coolant and lubricant in metal cutting oils (HSDB, 1993). Methyl chloroform is listed in the federal Clean Air Act as a Class I compound (stratospheric ozone depletor), with production to be phased out as of January 2002, except for certain essential uses (U.S. EPA, 1990b).

The primary stationary sources that have reported emissions of methyl chloroform in California are manufacturers of miscellaneous plastics products, metal products manufacturers, and manufacturers of aircraft and parts (ARB, 1997b).

Methyl chloroform was registered for use as a pesticide; however as of April 13, 1988, it is no longer registered for pesticidal use in California (DPR, 1996).

B. Emissions

The total emissions of methyl chloroform from stationary sources in California are estimated to be at least 27 million pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of methyl chloroform was found in the readily-available literature.

AMBIENT CONCENTRATIONS

Methyl chloroform is routinely monitored by the statewide Air Resources Board air toxics network. The network's mean concentration of methyl chloroform from January 1996 through December 1996 is estimated to be 1.59 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or 0.294 parts per billion (ppb) (ARB, 1997c).

The United States Environmental Protection Agency (U.S. EPA) has also compiled ambient air data from several study areas throughout the United States. Data from 13 study areas from 1989 to 1991 reported an overall mean concentration of $5.6 \mu\text{g}/\text{m}^3$ (1.0 ppb) (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

The most recent California study measuring methyl chloroform was conducted in Woodland, California during the spring of 1990. The average indoor concentration of methyl chloroform from 124 samples was $7.1 \mu\text{g}/\text{m}^3$. The mean concentration for personal exposure to methyl chloroform was $22 \mu\text{g}/\text{m}^3$. Mean indoor concentrations from the study were approximately 5 times greater than the outdoor mean concentrations (Sheldon et al., 1992).

The California Total Exposure Assessment Methodology (TEAM) studies were conducted during 1984 and 1987. Los Angeles and Contra Costa County were included in the 1984 study, while Los Angeles was the only area for the 1987 study. Mean indoor methyl chloroform concentrations measured in the TEAM studies ranged from 14 to $24 \mu\text{g}/\text{m}^3$; the 90th percentile values ranged from 24 to $50 \mu\text{g}/\text{m}^3$. Indoor concentrations were only slightly higher than outside concentrations (Pellizari et al., 1987b; 1989).

In an indoor air study of a newly constructed office building, the mean indoor concentration of methyl chloroform is reported to be $180 \mu\text{g}/\text{m}^3$ with the reported maximum concentration of $870 \mu\text{g}/\text{m}^3$ (Sheldon et al., 1988a).

ATMOSPHERIC PERSISTENCE

Methyl chloroform exists in the atmosphere in the gas phase. The dominant tropospheric loss process for methyl chloroform is by reaction with the hydroxyl (OH) radical. Based on this reaction, the atmospheric half-life and lifetime of methyl chloroform is estimated to be 3.7 years and 5.4 years, respectively (WMOGRMP, 1995). The tropospheric lifetime of methyl chloroform is sufficiently long that a few percent of the methyl chloroform emitted into the troposphere is transported into the stratosphere where it undergoes photolysis to release a chlorine atom. The product of the tropospheric OH radical reaction is CCl_3CHO , which reacts further to form phosgene and a chlorine atom (which forms hydrogen chloride in the troposphere) (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer health effects, methyl chloroform contributed to the total hazard index in 38 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1, and presented an individual hazard index greater than 1 in 8 of these risk assessments. Methyl chloroform also contributed to the total hazard index in 25 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1, and presented an individual hazard index greater than 1 in 1 of these risk assessments (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to methyl chloroform are inhalation, ingestion, and dermal contact.

Non-Cancer: Methyl chloroform is a central nervous system depressant, and is mildly irritating to the eyes and respiratory system in humans. Acute inhalation exposure in humans may cause hypotension, mild hepatic effects, dizziness, nausea, vomiting, diarrhea, and respiratory arrest. Methyl chloroform also sensitizes the myocardium to the arrhythmogenic effects of epinephrine. In most chronic exposure studies, adverse effects in humans have not been reported. In one study, ventricular arrhythmias were observed following chronic exposure to high levels (U.S. EPA, 1994a).

An acute non-cancer Reference Exposure Level (REL) of $1.9 \times 10^5 \mu\text{g}/\text{m}^3$ and a chronic REL of $3.2 \times 10^2 \mu\text{g}/\text{m}^3$ are listed for methyl chloroform in the California Air Pollution Control Officers Association Air Toxics “Hot Spots” Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the central and peripheral nervous systems, gastrointestinal system, liver, and reproductive system. The endpoint for acute toxicity is the central nervous system (CAPCOA, 1993). The U.S. EPA

has the Reference Concentration (RfC) under review, and has not established an oral Reference Dose (RfD) for methyl chloroform (U.S. EPA, 1994a).

No information is available on adverse reproductive or developmental effects of methyl chloroform in humans. Limited studies are available on the developmental effects of methyl chloroform by inhalation and oral exposure in animals. No evidence of adverse reproductive effects from methyl chloroform was found in several animal species (U.S. EPA, 1994a).

Cancer: Information is not available on the carcinogenic effects of methyl chloroform in humans. The U.S. EPA considers the available data from animal studies to be inadequate, and has classified methyl chloroform in Group D: Not classifiable as to human carcinogenicity, based on no reported human data and inadequate animal data (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified methyl chloroform (1,1,1-trichloroethane) in Group 3: Not classifiable (IARC, 1987a).